WHAT IS CLAIMED IS:

1. A multi-beam optical scanning apparatus comprising:

a light source unit having at least three light emitting portions disposed with being spaced from each other in a main-scanning direction;

a first optical system for changing conditions of at least three divergent light beams emitted from the light source unit;

a stop for restricting widths of the at least three light beams transmitted through the first optical system at least in the main-scanning direction;

a deflecting unit for reflecting the at least three light beams transmitted through the stop;

a second optical system for forming images of the at least three light beams reflected by the deflecting unit on a surface to be scanned; and

a detecting unit for detecting a writing start position synchronous signal for controlling timing of a scanning start position on the surface to be scanned, the writing start position synchronous signal detecting unit including a detecting device for detecting the writing start position synchronous signal, and a slit member disposed in an optical path between the writing start position synchronous signal detecting device and the deflecting unit, and the

writing start position synchronous signal detecting
unit being adapted to control the timing of the
scanning start position on the surface to be scanned
by using a light beam reflected by the deflecting
5    unit and transmitted through the slit member;
      wherein a condition given by

$$\left| P \sin\alpha \tan\beta + \frac{S_1 L_1}{f_1 f_2} \left( \delta M_{(\beta)} - \delta M_{(\beta D)} \right) \right| \le \frac{25.4}{3 N_M}$$

is satisfied, where $S_1$ is the spacing in the main-
scanning direction between light emitting portions at
10    opposite ends in the at least three light emitting
portions, $f_1$ is the focal length of the first optical
system, $L_1$ is the distance between the stop and a
deflecting facet of the deflecting unit, $f_2$ is the
focal length of the second optical system in the
15    main-scanning direction, $\alpha$ is an average of angles
formed between principal rays of the at least three
light beams incident on the surface to be scanned and
a normal to the surface to be scanned in a sub-
scanning section, $\beta$ is an average of angles formed
20    between the principal rays of the at least three
light beams incident at any scanning location on the
surface to be scanned and the normal to the surface
to be scanned in a main-scanning section, $\delta M_{(\beta)}$ is the
main-scanning focus displacement amount at the

scanning location of the average $\beta$, $\delta M_{(BD)}$ is the main-scanning focus displacement amount at a scanning location whereat the at least three light beams pass through the slit member, $N_M$ is the number of pixels

5 per inch in the main-scanning direction which is determined from a resolution in the main-scanning direction on the surface to be scanned, and P is the spacing in the sub-scanning direction between image spots of light beams emitted from light emitting

10 portions at opposite ends in the at least three light emitting portions on the surface to be scanned.

2. A multi-beam optical scanning apparatus comprising:

15 a light source unit having at least three light emitting portions disposed with being spaced from each other in a main-scanning direction;

a first optical system for changing conditions of at least three divergent light beams emitted from

20 the light source unit;

a stop for restricting widths of the at least three light beams transmitted through the first optical system at least in the main-scanning direction;

25 a deflecting unit for reflecting the at least three light beams transmitted through the stop;

a second optical system for forming images of

the at least three light beams reflected by the deflecting unit on a surface to be scanned; and

a detecting unit for detecting a writing start position synchronous signal for controlling timing of a scanning start position on the surface to be scanned, the writing start position synchronous signal detecting unit including a third optical system disposed independently from the second optical system, a detecting device for detecting the writing start position synchronous signal, and a slit member disposed in an optical path between the writing start position synchronous signal detecting device and the third optical system unit, and the writing start position synchronous signal detecting unit being adapted to control the timing of the scanning start position on the surface to be scanned by using a light beam reflected by the deflecting unit;

wherein a condition given by

$$\left| P \sin \alpha \tan \beta + \frac{S_1 L_1}{f_1 f_2} \delta M_{(\beta)} - \frac{S_1 L_1}{f_1 f_3} \delta M_{(BD)} \right| \le \frac{25.4}{3 N_M}$$

is satisfied, where $S_1$ is the spacing in the main-scanning direction between light emitting portions at opposite ends in the at least three light emitting portions, $f_1$ is the focal length of the first optical system, $L_1$ is the distance between the stop and a

deflecting facet of the deflecting unit, $f_2$ is the focal length of the second optical system in the main-scanning direction, $f_3$ is the focal length of the third optical system in the main-scanning

5    direction, $\alpha$ is an average of angles formed between principal rays of the at least three light beams incident on the surface to be scanned and a normal to the surface to be scanned in a sub-scanning section, $\beta$ is an average of angles formed between the

10   principal rays of the at least three light beams incident at any scanning location on the surface to be scanned and the normal to the surface to be scanned in a main-scanning section, $\delta M_{(\beta)}$ is the main-scanning focus displacement amount at the scanning

15   location of the average $\beta$, $\delta M_{(BD)}$ is the main-scanning focus displacement amount at a scanning location whereat the at least three light beams pass through the slit member, $N_M$ is the number of pixels per inch in the main-scanning direction which is determined

20   from a resolution in the main-scanning direction on the surface to be scanned, and P is the spacing in the sub-scanning direction between image spots of light beams emitted from light emitting portions at opposite ends in the at least three light emitting

25   portions on the surface to be scanned


3. A multi-beam optical scanning apparatus

according to claim 1, wherein the writing start
position synchronous signal detecting unit is adapted
to control the timing of the scanning start position
on the surface to be scanned by using all of the at
5   least three light beams reflected by the deflecting
unit.

4. A multi-beam optical scanning apparatus
according to claim 2, wherein the writing start
10   position synchronous signal detecting unit is adapted
to control the timing of the scanning start position
on the surface to be scanned by using all of the at
least three light beams reflected by the deflecting
unit.
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5. A multi-beam optical scanning apparatus
according to claim 1, wherein the slit member is
adapted to be movable in a direction in which the at
least three light beams incident on the slit member
20   travel.

6. A multi-beam optical scanning apparatus
according to claim 2, wherein the slit member is
adapted to be movable in a direction in which the at
25   least three light beams incident on the slit member
travel.

7. A multi-beam optical scanning apparatus according to claim 1, wherein the slit member is adapted to be rotatable in a section approximately perpendicular to the direction in which the at least
5   three light beams incident on the slit member travel.

8. A multi-beam optical scanning apparatus according to claim 2, wherein the slit member is adapted to be rotatable in a section approximately
10   perpendicular to the direction in which the at least three light beams incident on the slit member travel.

9. A multi-beam optical scanning apparatus according to claim 1, wherein a light beam reflected
15   by the deflecting unit and incident on the writing start position synchronous signal detecting device is adapted to pass through the second optical system.

10. An image forming apparatus comprising:
20       a multi-beam optical scanning apparatus recited in any one of claims 1 to 9;

a photosensitive member disposed on the surface to be scanned;

a developing device for developing as a toner
25   image an electrostatic latent image formed on the photosensitive member by the light beams scanned by the multi-beam optical scanning apparatus;

a transferring device for transferring the
developed toner image onto a transferring material;
and

a fixing device for fixing the transferred
5    toner image to the transferring material.


11. An image forming apparatus comprising:
a multi-beam optical scanning apparatus recited
in any one of claims 1 to 9; and
10    a printer controller for converting code data
input from an external equipment into an image signal,
and inputting the image signal into the multi-beam
optical scanning apparatus.


15    12. A color image forming apparatus comprising:
multi-beam optical scanning apparatuses recited
in any one of claims 1 to 9; and
a plurality of image bearing members each of
which is disposed on the surface to be scanned of
20    each of the multi-beam optical scanning apparatuses,
and on which different color images are formed,
respectively.


13. A color image forming apparatus according
25    to claim 12, further comprising a printer controller
for converting color signals input from an external
equipment into image data of different colors, and

inputting the image data into the multi-beam optical
scanning apparatuses, respectively.


    14. A multi-beam optical scanning apparatus
5   comprising:

      a light source unit having at least three light
emitting portions disposed with being spaced from
each other in a main-scanning direction;

      a first optical system for changing conditions
10  of at least three divergent light beams emitted from
the light source unit;

      a stop for restricting widths of the at least
three light beams transmitted through the first
optical system at least in the main-scanning
15  direction;

      a deflecting unit for reflecting the at least
three light beams transmitted through the stop;

      a second optical system for forming images of
the at least three light beams reflected by the
20  deflecting unit on a surface to be scanned; and

      a detecting unit for detecting a writing start
position synchronous signal for controlling timing of
a scanning start position on the surface to be
scanned, the writing start position synchronous
25  signal detecting unit including a detecting device
for detecting the writing start position synchronous
signal;

wherein a condition given by

$$\left| P \sin \alpha \tan \beta + \frac{S_1 L_1}{f_1 f_2} \left( \delta M_{(\beta)} - \delta M_{(BD)} \right) \right| \leq \frac{25.4}{3N_M}$$

is satisfied, where $S_1$ is the spacing in the main-scanning direction between light emitting portions at

5   opposite ends in the at least three light emitting portions, $f_1$ is the focal length of the first optical system, $L_1$ is the distance between the stop and a deflecting facet of the deflecting unit, $f_2$ is the focal length of the second optical system in the

10  main-scanning direction, $\alpha$ is an average of angles formed between principal rays of the at least three light beams incident on the surface to be scanned and a normal to the surface to be scanned in a sub-scanning section, $\beta$ is an average of angles formed

15  between the principal rays of the at least three light beams incident at any scanning location on the surface to be scanned and the normal to the surface to be scanned in a main-scanning section, $\delta M_{(\beta)}$ is the main-scanning focus displacement amount at the

20  scanning location of the average $\beta$, $\delta M_{(BD)}$ is the main-scanning focus displacement amount at a light receiving surface whereat the writing start position synchronous signal detecting device receives the at least three light beams, $N_M$ is the number of pixels

per inch in the main-scanning direction which is
determined from a resolution in the main-scanning
direction on the surface to be scanned, and P is the
spacing in the sub-scanning direction between image

5   spots of light beams emitted from light emitting
portions at opposite ends in the at least three light
emitting portions on the surface to be scanned.


        15. A multi-beam optical scanning apparatus
10  comprising:
        a light source unit having at least three light
emitting portions disposed with being spaced from
each other in a main-scanning direction;
        a first optical system for changing conditions
15  of at least three divergent light beams emitted from
the light source unit;
        a stop for restricting widths of the at least
three light beams transmitted through the first
optical system at least in the main-scanning
20  direction;
        a deflecting unit for reflecting the at least
three light beams transmitted through the stop;
        a second optical system for forming images of
the at least three light beams reflected by the
25  deflecting unit on a surface to be scanned; and
        a detecting unit for detecting a writing start
position synchronous signal for controlling timing of

a scanning start position on the surface to be
scanned, the writing start position synchronous
signal detecting unit including a third optical
system disposed independently from the second optical
5   system, and a detecting device for detecting the
writing start position synchronous signal;

wherein a condition given by

$$\left| P \sin\alpha \tan\beta + \frac{S_1 L_1}{f_1 f_2} \delta M_{(\beta)} - \frac{S_1 L_1}{f_1 f_3} \delta M_{(BD)} \right| \le \frac{25.4}{3N_M}$$

is satisfied, where $S_1$ is the spacing in the main-
10   scanning direction between light emitting portions at
opposite ends in the at least three light emitting
portions, $f_1$ is the focal length of the first optical
system, $L_1$ is the distance between the stop and a
deflecting facet of the deflecting unit, $f_2$ is the
15   focal length of the second optical system in the
main-scanning direction, $f_3$ is the focal length of
the third optical system in the main-scanning
direction, $\alpha$ is an average of angles formed between
principal rays of the at least three light beams
20   incident on the surface to be scanned and a normal to
the surface to be scanned in a sub-scanning section,
$\beta$ is an average of angles formed between the
principal rays of the at least three light beams
incident at any scanning location on the surface to

be scanned and the normal to the surface to be scanned in a main-scanning section, $\delta M_{(\beta)}$ is the main-scanning focus displacement amount at the scanning location of the average $\beta$, $\delta M_{(BD)}$ is the main-scanning

5    focus displacement amount at a light receiving surface whereat the writing start position synchronous signal detecting device receives the at least three light beams, $N_M$ is the number of pixels per inch in the main-scanning direction which is

10   determined from a resolution in the main-scanning direction on the surface to be scanned, and P is the spacing in the sub-scanning direction between image spots of light beams emitted from light emitting portions at opposite ends in the at least three light

15   emitting portions on the surface to be scanned.


16. A multi-beam optical scanning apparatus according to claim 14, wherein the writing start position synchronous signal detecting unit is adapted

20   to control the timing of the scanning start position on the surface to be scanned by using all of the at least three light beams reflected by the deflecting unit.


25   17. A multi-beam optical scanning apparatus according to claim 15, wherein the writing start position synchronous signal detecting unit is adapted

to control the timing of the scanning start position
on the surface to be scanned by using all of the at
least three light beams reflected by the deflecting
unit.

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18. A multi-beam optical scanning apparatus
according to claim 14, wherein a light beam reflected
by the deflecting unit and incident on the writing
start position synchronous signal detecting device is
10 adapted to pass through the second optical system.

19. An image forming apparatus comprising:
a multi-beam optical scanning apparatus recited
in any one of claims 14 to 18;
15 a photosensitive member disposed on the surface
to be scanned;
a developing device for developing as a toner
image an electrostatic latent image formed on the
photosensitive member by the light beams scanned by
20 the multi-beam optical scanning apparatus;
a transferring device for transferring the
developed toner image onto a transferring material;
and
a fixing device for fixing the transferred
25 toner image to the transferring material.

20. An image forming apparatus comprising:

a multi-beam optical scanning apparatus recited in claim 19; and

a printer controller for converting code data input from an external equipment into an image signal, and inputting the image signal into the multi-beam optical scanning apparatus.

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21. A color image forming apparatus comprising:

multi-beam optical scanning apparatuses recited in any one of claims 14 to 18; and

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a plurality of image bearing members each of which is disposed on the surface to be scanned of each of the multi-beam optical scanning apparatuses, and on which different color images are formed, respectively.

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22. A color image forming apparatus according to claim 21, further comprising a printer controller for converting color signals input from an external equipment into image data of different colors, and inputting the image data into the multi-beam optical scanning apparatuses, respectively.

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